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Contact Information

Dr. Patricia Reiff | reiff@rice.edu
Physics & Astronomy, MS-108
Rice University
6100 Main Street
Houston, TX 77005-1892

PHYS 501 : Physics of Ham Radio

DESCRIPTION | OVERVIEW | LEARNING GOALS | CLASS DETAILS | SCHEDULE | HOMEWORK

NEXT OFFERED: Fall 2018 (tentative)
MONDAY EVENINGS, 6 - 9 pm, HBH 355

DESCRIPTION

Fundamentals of electromagnetic waves and propagation, the ionosphere and space weather. Basic electronics, antenna design and safety. Provides information necessary to earn the "Technician" level of FCC amateur ("ham") radio license. Mathematics at a level below calculus. Other topics include: use of GPS, solar storms, magnetic reconnection and the MMS Mission, and geocaching.
Open to all undergraduate and graduate students - I will sign special registration forms for undergrads.

OVERVIEW

This class teaches the basics of electromagnetic waves, simple circuit and antenna theory, radio propagation, GPS theory and operation, ionosphere, magnetosphere, and space weather. The course midterm is the FCC "technician"-level ham radio test. It is expected that all students will pass the test before the end of the semester (retakes are acceptable), allowing legal broadcasting on all frequencies above 50 MHz (including popular 2m repeater networks and talking to the ISS) and selected HF frequencies. The second half of the course covers GPS and space weather topics. The students will have one general electrical circuit lab and also construct a simple AM receiver. Antenna installation costs were paid for by the Physics and Astronomy Department. NOTE: This class does count towards the "Master of Science Teaching" degree, but is a free elective ONLY for most other degree programs.

A short powerpoint on the uses of amateur radio or on the effects of space weather is required as one of the homework sets [View papers from 2007 Spring class | 2009 Spring class | 2013 Spring class]. All students who enrolled in the Spring 2007, 2009, 2010, 2011 and 2013 and 2017 classes passed their "technician"-level FCC license exam, and several have passed their General level. One student who began as a "General" passed his "Extra" exam. Extra credit for passing higher levels before the end of finals.

Click here for an article about the success of the 2005 class, including their names and new callsigns, and more details about the class.

LEARNING GOALS

As a result of this class, the student is expected to:
1. Pass the "Technician" Level FCC ham license examination.
2. Be able to calculate wavelength from frequency and vice versa.
3. Be able to calculate voltage, current, resistance and power from simple DC and AC circuits, and resonant frequency of AC circuits.
4. Be able to calculate the length of antenna resonant with a given frequency.
5. Communication: be able to write a paper or powerpoint on the use of ham radio in emergencies or the effects of space weather.
6. Communication: Make at least ten legal ham radio contacts, 5 in HF and 5 in UHF/VHF.
7. Be able to understand and explain the formation of the ionosphere and calculate the critical frequency from the peak density.
8. Be able to explain the two modes of solar eruptions and the consequences of each.
9. Be able to use a GPS device to find location of hidden objects.
10. Be able to understand the interaction of the solar wind with the Earth's magnetosphere and predict consequences of solar flares and CMEs.
11. Be able to create and demonstrate a classroom lesson covering one or more of the topics of this course.

CLASS DETAILS

Take advantage of the NEW FCC RULES that NO LONGER REQUIRE MORSE CODE! If you don't have time to take the class, you can still join the Rice Ham Radio Club (Call W5YG). (Open to all hams and ham wanna-be's)

Instructor	Professor Patricia Reiff W5TAR (reiff@rice.edu); Phone: (713)348-4634; Office: HBH 226; Office hours by appointment
Classroom	HBH 223, 6:00 - 9:00 pm MONDAYS (Aug 20 - Nov 30) plus at least one field trip. Additional 4-5 radio nights as needed. Also uses HBH 355
Text	"Ham Radio License Manual THIRD EDITION ONLY"NOTE - WILL PROBABLY BE UPDATED TO 4TH EDITION WITH NEW LICENSE QUESTIONS (ARRL, $29.95, ISBN 978-1-62595-013-0 available from campus store or Amazon).
Also helpful	A personal GPS receiver (will be provided for students who do not have one); calculator
Prerequisites	Basic algebra (no calculus)
Students accepted	This class is suitable for students of all levels: undergrad, grad student, and teachers, but at present does not count for restricted distribution. It is strongly recommended for teachers in the Master of Science Teaching program but may or may not count towards other graduate degree programs: check with your advisor. Auditors allowed up to the 19-person limit on enrollment.
Course Grading	Each homework set has a variable point count. Quiz 1 is the FCC Ham Radio "Technician" exam which will count 20 points when passed. Quiz 2 will count 30 points. Homework will count approximately 40 points, including a special report which will count 12 points. Final grade is the number of points earned divided by the points possible.
Absences	No specific penalty for absences except getting behind in the subject. One in-class laboratory if missed, requires special permission to make up. Several evening "on the air" sessions for practice in both voice and digital transmission modes, UHF and HF frequencies.
Honor Code	Students may work together on homework but each student shall turn in their own work. Quiz 1 is administered by VECs from the FCC. Quiz 2 is takehome, is subject to the honor code and must individual work and be signed.
Students with disabilities	Students needing accommodations should check with the instructor and also with the Disability Support Services. We will attempt every reasonable accommodation. For example, radio contacts can be made by digital modes for the hearing impaired.
Subject to Change	Details of the homework and schedule of class sessions are subject to change. All changes will be sent by email to all students enrolled in the course.

DETAILED SCHEDULE : SPRING 2017 (NOT YET UPDATED TO FALL 2018)

DATE	MATERIAL
Jan 10	Organizational meeting. Will decide on the class day of the week for the rest of the semester (probably Tuesdays). Introduction to Ham Radio. Book Chapter 1 and 2A. ARRL Module 1 & 2.
DATE	**MATERIAL**
Jan 17	Book Chapter 2B and 3A. ARRL Modules 3 4 & 5.(Jan 20 = ADD DEADLINE)
DATE	**MATERIAL**
Jan 24	ook Chapter 3B. ARRL Module 6. DC Circuit Lab.
DATE	**MATERIAL**
Jan 31	Book Chapter 3C. ARRL Modules 7. On the Air time.
DATE	**MATERIAL**
Feb 7	Book Chapter 4. ARRL Modules 8, 9 & 10. Antenna demos.
DATE	**MATERIAL**
Feb 14	Book Chapter 5 & 6. ARRL Modules 11 - 14.

DATE	MATERIAL
Feb 21	Book Ch 7-9. Modules 15 - 18. NOTE: Drop Deadline Feb 24
DATE	**MATERIAL**
Feb 28	Volunteer Exam or TBD
DATE	**MATERIAL**
Mar 6	Volunteer Exam or TBD
DATE	**MATERIAL**
Mar 14	NO CLASS - SPRING BREAK
DATE	**MATERIAL**
Mar 21	Book Ch 7-9. ARRL Modules 15 - 18
DATE	**MATERIAL**
Mar 21 AND 23	putting together crystal radios or Tesla coils (advanced students)
DATE	**MATERIAL**
March 25	Hamfest field trip - Rosenberg (VE retake if needed)
DATE	**MATERIAL**
Mar 28	The Sun and Space Weather
DATE	**MATERIAL**
April 4	The ionosphere and magnetosphere; Solar Eclipse 2017
DATE	**MATERIAL**
April 11	GPS; Satellite Operations
DATE	**MATERIAL**
April 18	MMS and Magnetic Reconnection; Class Report Presentations
DATE	**MATERIAL**
April 20	Class Report Presentations (if needed)

HOMEWORK (Fall 2018 (tentative))

- **Homework 1**: Waves and DC circuits
- **Homework 2**: DC circuits lab
- **Homework 3**: AC circuits
- **Homework 4**: Operation. Start your Ham log for homework 9.
- **Homework 5**: Antennas
- **Homework 6**: Sun and Space Weather
- **Homework 7**: Paper on Ham Radio in use, or space weather
- **Homework 8**: GPS Activity
- **Homework 9**: Turn in log sheet for your on the air contacts (5 UHF/VHF and 5 HF) (if not done before)
- **Homework 10**: Make a class presentation of an activity you would do with your students to teach one or more of these topics.

Rice Space Institute 6100 Main MS-108, Houston, Texas 77005-1827 Mailing Address: P.O. Box 1892, Houston, Texas 77251-1892

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